



SEQUENCE LISTING

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<110> Svendsen, Allan
Bisgard-Frantzen, Henrik
Borchert, Torben Vedel

<120> Alpha-Amylase Mutants

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<141> 1999-06-08

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Pro Pro Ala Tyr Lys Gly Thr Ser Gln Ala Asp Val Gly Tyr Gly Ala	
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Tyr Asp Leu Tyr Asp Leu Gly Glu Phe His Gln Lys Gly Thr Val Arg	
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Thr Lys Tyr Gly Thr Lys Gly Glu Leu Gln Ser Ala Ile Lys Ser Leu	
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Trp His Trp Tyr His Phe Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys	
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Gly	Gly	Gly	Tyr	Asp	Met	Arg	Lys	Leu	Leu	Asn	Gly	Thr	Val	Val	Ser	
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-25

-20

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Pro Gly Gly Ser Lys Arg Met Tyr Ala Gly Leu Lys Asn Ala Gly Glu				
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aca tgg tat gac ata acg ggc aac cgt tca gat act gta aaa atc gga				1731
Thr Trp Tyr Asp Ile Thr Gly Asn Arg Ser Asp Thr Val Lys Ile Gly				
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Ser Asp Gly Trp Gly Glu Phe His Val Asn Asp Gly Ser Val Ser Ile				
	465	470	475	
tat gtt cag aaa taaggtaata aaaaaacacc tccaagctga gtgcgggtat				1831
F ₅ Tyr Val Gln Lys				
	480			
cagcttgag gtgcgtttat tttttcagcc gtatgacaag gtcggcatca ggtgtgacaa				1891
atacggtatg ctggctgtca taggtgacaa atccgggttt tgcgccgttt ggctttttca				1951
catgtctgat ttttgtataa tcaacaggca cggagccgga atctttcgcc ttggaaaaat				2011
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Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Thr Pro Asn Asp Gly				
35 40 45				
Gln His Trp Lys Arg Leu Gln Asn Asp Ala Glu His Leu Ser Asp Ile				
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Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Tyr Lys Gly Leu Ser Gln				
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Ser Asp Asn Gly Tyr Gly Pro Tyr Asp Leu Tyr Asp Leu Gly Glu Phe				
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Gln Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ser Glu Leu				
100 105 110				
Gln Asp Ala Ile Gly Ser Leu His Ser Arg Asn Val Gln Val Tyr Gly				
115 120 125				
Asp Val Val Leu Asn His Lys Ala Gly Ala Asp Ala Thr Glu Asp Val				
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Thr Ala Val Glu Val Asn Pro Ala Asn Arg Asn Gln Glu Thr Ser Glu				
145 150 155 160				

F5

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Asp	Tyr	Leu	Met	Tyr	Ala	Asp	Val	Asp	Tyr	Asp	His	Pro	Asp	Val	Val		
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Ala	Glu	Thr	Lys	Lys	Trp	Gly	Ile	Trp	Tyr	Ala	Asn	Glu	Leu	Ser	Leu		
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Thr	Val	Ala	Glu	Tyr	Trp	Gln	Asn	Asn	Ala	Gly	Lys	Leu	Glu	Asn	Tyr		
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Leu	Asn	Lys	Thr	Ser	Phe	Asn	Gln	Ser	Val	Phe	Asp	Val	Pro	Leu	His		
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Phe	Asn	Leu	Gln	Ala	Ala	Ser	Ser	Gln	Gly	Gly	Gly	Tyr	Asp	Met	Arg		
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Lys	Gly	Thr	Ser	Pro	Lys	Glu	Ile	Pro	Ser	Leu	Lys	Asp	Asn	Ile	Glu		
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Tyr	Ile	Asp	His	Pro	Asp	Val	Ile	Gly	Trp	Thr	Arg	Glu	Gly	Asp	Ser		
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Ser	Ala	Ala	Lys	Ser	Gly	Leu	Ala	Ala	Leu	Ile	Thr	Asp	Gly	Pro	Gly		
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tcgaatgtaa	catttgatta	agggggaagg	gcatt	gtg cta acg ttt cac cgc		173

Val Leu Thr Phe His Arg

-30

atc att cga aaa gga tgg atg ttc ctg ctc gcg ttt ttg ctc act gtc	221
Ile Ile Arg Lys Gly Trp Met Phe Leu Leu Ala Phe Leu Leu Thr Val	
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F5

tcg ctg ttc tgc cca aca gga cag ccc gcc aag gct gcc gca ccg ttt	269
Ser Leu Phe Cys Pro Thr Gly Gln Pro Ala Lys Ala Ala Pro Phe	
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aac ggc acc atg atg cag tat ttt gaa tgg tac ttg ccg gat gat ggc	317
Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr Leu Pro Asp Asp Gly	
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acg tta tgg acc aaa gtg gcc aat gaa gcc aac aac tta tcc agc ctt	365
Thr Leu Trp Thr Lys Val Ala Asn Glu Ala Asn Asn Leu Ser Ser Leu	
25 30 35	

ggc atc acc gct ctt tgg ctg ccg ccc gct tac aaa gga aca agc cgc	413
Gly Ile Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys Gly Thr Ser Arg	
40 45 50	

agc gac gta ggg tac gga gta tac gac ttg tat gac ctc ggc gaa ttc	461
Ser Asp Val Gly Tyr Gly Val Tyr Asp Leu Tyr Asp Leu Gly Glu Phe	
55 60 65	

aat caa aaa ggg acc gtc cgc aca aaa tac gga aca aaa gct caa tat	509
Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ala Gln Tyr	
70 75 80	

ctt caa gcc att caa gcc gcc cac gcc gct gga atg caa gtg tac gcc	557
Leu Gln Ala Ile Gln Ala Ala His Ala Ala Gly Met Gln Val Tyr Ala	
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gat gtc gtg ttc gac cat aaa ggc ggc gct gac ggc acg gaa tgg gtg	605
Asp Val Val Phe Asp His Lys Gly Gly Ala Asp Gly Thr Glu Trp Val	
105 110 115	

gac gcc gtc gaa gtc aat ccg tcc gac cgc aac caa gaa atc tcg ggc	653
Asp Ala Val Glu Val Asn Pro Ser Asp Arg Asn Gln Glu Ile Ser Gly	
120 125 130	

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Thr	Tyr	Gln	Ile	Gln	Ala	Trp	Thr	Lys	Phe	Asp	Phe	Pro	Gly	Arg	Gly	
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Asn	Thr	Tyr	Ser	Ser	Phe	Lys	Trp	Arg	Trp	Tyr	His	Phe	Asp	Gly	Val	
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gat	tgg	gac	gaa	agc	cga	aaa	ttg	agc	cgc	att	tac	aaa	ttc	cgc	ggc	797
Asp	Trp	Asp	Glu	Ser	Arg	Lys	Leu	Ser	Arg	Ile	Tyr	Lys	Phe	Arg	Gly	
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Ile	Gly	Lys	Ala	Trp	Asp	Trp	Glu	Val	Asp	Thr	Glu	Asn	Gly	Asn	Tyr	
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gac	tac	tta	atg	tat	gcc	gac	ctt	gat	atg	gat	cat	ccc	gaa	gtc	gtg	893
Asp	Tyr	Leu	Met	Tyr	Ala	Asp	Leu	Asp	Met	Asp	His	Pro	Glu	Val	Val	
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acc	gag	ctg	aaa	aac	tgg	ggg	aaa	tgg	tat	gtc	aac	aca	acg	aac	att	941
Thr	Glu	Leu	Lys	Asn	Trp	Gly	Lys	Trp	Tyr	Val	Asn	Thr	Thr	Asn	Ile	
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Asp	Gly	Phe	Arg	Leu	Asp	Ala	Val	Lys	His	Ile	Lys	Phe	Ser	Phe	Phe	
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cct	gat	tgg	ttg	tcg	tat	gtg	cgt	tct	cag	act	ggc	aag	ccg	cta	ttt	1037
Pro	Asp	Trp	Leu	Ser	Tyr	Val	Arg	Ser	Gln	Thr	Gly	Lys	Pro	Leu	Phe	
245					250					255					260	
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Thr	Val	Gly	Glu	Tyr	Trp	Ser	Tyr	Asp	Ile	Asn	Lys	Leu	His	Asn	Tyr	
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Ile	Thr	Lys	Thr	Asp	Gly	Thr	Met	Ser	Leu	Phe	Asp	Ala	Pro	Leu	His	
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Asn	Lys	Phe	Tyr	Thr	Ala	Ser	Lys	Ser	Gly	Gly	Ala	Phe	Asp	Met	Arg	
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Thr	Leu	Met	Thr	Asn	Thr	Leu	Met	Lys	Asp	Gln	Pro	Thr	Leu	Ala	Val	
	310					315					320					
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Thr	Phe	Val	Asp	Asn	His	Asp	Thr	Glu	Pro	Gly	Gln	Ala	Leu	Gln	Ser	
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F5

Trp	Val	Asp	Pro	Trp	Phe	Lys	Pro	Leu	Ala	Tyr	Ala	Phe	Ile	Leu	Thr		
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Arg	Gln	Glu	Gly	Tyr	Pro	Cys	Val	Phe	Tyr	Gly	Asp	Tyr	Tyr	Gly	Ile		
			360					365					370				
cca	caa	tat	aac	att	cct	tgc	ctg	aaa	agc	aaa	atc	gat	ccg	ctc	ctc	1421	
Pro	Gln	Tyr	Asn	Ile	Pro	Ser	Leu	Lys	Ser	Lys	Ile	Asp	Pro	Leu	Leu		
		375					380					385					
atc	gcg	cgc	agg	gat	tat	gct	tac	gga	acg	caa	cat	gat	tat	ctt	gat	1469	
Ile	Ala	Arg	Arg	Asp	Tyr	Ala	Tyr	Gly	Thr	Gln	His	Asp	Tyr	Leu	Asp		
	390					395				400							
cac	tcc	gac	atc	atc	ggg	tgg	aca	agg	gaa	ggg	ggc	act	gaa	aaa	cca	1517	
His	Ser	Asp	Ile	Ile	Gly	Trp	Thr	Arg	Glu	Gly	Gly	Thr	Glu	Lys	Pro		
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gga	tcc	gga	ctg	gcc	gca	ctg	atc	acc	gat	ggg	ccg	gga	gga	agc	aaa	1565	
Gly	Ser	Gly	Leu	Ala	Ala	Leu	Ile	Thr	Asp	Gly	Pro	Gly	Gly	Ser	Lys		
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Trp	Met	Tyr	Val	Gly	Lys	Gln	His	Ala	Gly	Lys	Val	Phe	Tyr	Asp	Leu		
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Thr	Gly	Asn	Arg	Ser	Asp	Thr	Val	Thr	Ile	Asn	Ser	Asp	Gly	Trp	Gly		
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gaa	ttc	aaa	gtc	aat	ggc	ggg	tgc	gtt	tgc	gtt	tgg	gtt	cct	aga	aaa	1709	
Glu	Phe	Lys	Val	Asn	Gly	Gly	Ser	Val	Ser	Val	Trp	Val	Pro	Arg	Lys		
	470					475					480						
acg	acc	gtt	tct	acc	atc	gct	cgg	ccg	atc	aca	acc	cga	ccg	tgg	act	1757	
Thr	Thr	Val	Ser	Thr	Ile	Ala	Arg	Pro	Ile	Thr	Thr	Arg	Pro	Trp	Thr		
	485				490					495					500		
ggg	gaa	ttc	gtc	cgt	tgg	acc	gaa	cca	cgg	ttg	gtg	gca	tgg	cct		1802	
Gly	Glu	Phe	Val	Arg	Trp	Thr	Glu	Pro	Arg	Leu	Val	Ala	Trp	Pro			
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Tyr	Leu	Pro	Asp	Asp	Gly	Thr	Leu	Trp	Thr	Lys	Val	Ala	Asn	Glu	Ala		
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65					70					75					80		
Tyr	Lys	Gly	Thr	Ser	Arg	Ser	Asp	Val	Gly	Tyr	Gly	Val	Tyr	Asp	Leu		
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Tyr	Asp	Leu	Gly	Glu	Phe	Asn	Gln	Lys	Gly	Thr	Val	Arg	Thr	Lys	Tyr		
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Tyr	His	Phe	Asp	Gly	Val	Asp	Trp	Asp	Glu	Ser	Arg	Lys	Leu	Ser	Arg		
		195					200					205					
Ile	Tyr	Lys	Phe	Arg	Gly	Ile	Gly	Lys	Ala	Trp	Asp	Trp	Glu	Val	Asp		
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Thr	Glu	Asn	Gly	Asn	Tyr	Asp	Tyr	Leu	Met	Tyr	Ala	Asp	Leu	Asp	Met		
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Asp	His	Pro	Glu	Val	Val	Thr	Glu	Leu	Lys	Asn	Trp	Gly	Lys	Trp	Tyr		
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Val	Asn	Thr	Thr	Asn	Ile	Asp	Gly	Phe	Arg	Leu	Asp	Ala	Val	Lys	His		
			260					265					270				
Ile	Lys	Phe	Ser	Phe	Phe	Pro	Asp	Trp	Leu	Ser	Tyr	Val	Arg	Ser	Gln		
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Thr	Gly	Lys	Pro	Leu	Phe	Thr	Val	Gly	Glu	Tyr	Trp	Ser	Tyr	Asp	Ile		
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Asn	Lys	Leu	His	Asn	Tyr	Ile	Thr	Lys	Thr	Asp	Gly	Thr	Met	Ser	Leu		
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Phe	Asp	Ala	Pro	Leu	His	Asn	Lys	Phe	Tyr	Thr	Ala	Ser	Lys	Ser	Gly		
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Gln	His	Asp	Tyr	Leu	Asp	His	Ser	Asp	Ile	Ile	Gly	Trp	Thr	Arg	Glu		
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36

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28

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Ala	Asp	Gln	Lys	Tyr	Cys	Gly	Gly	Thr	Trp	Gln	Gly	Ile	Ile	Asp	Lys		
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Leu	Asp	Tyr	Ile	Gln	Gly	Met	Gly	Phe	Thr	Ala	Ile	Trp	Ile	Thr	Pro		
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Val	Thr	Ala	Gln	Leu	Pro	Gln	Thr	Thr	Ala	Tyr	Gly	Asp	Ala	Tyr	His		
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Gly	Tyr	Trp	Gln	Gln	Asp	Ile	Tyr	Ser	Leu	Asn	Glu	Asn	Tyr	Gly	Thr		
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Ala	Asp	Asp	Leu	Lys	Ala	Leu	Ser	Ser	Ala	Leu	His	Glu	Arg	Gly	Met		
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Tyr	Leu	Met	Val	Asp	Val	Val	Ala	Asn	His	Met	Gly	Tyr	Asp	Gly	Ala		
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Gly	Ser	Ser	Val	Asp	Tyr	Ser	Val	Phe	Lys	Pro	Phe	Ser	Ser	Gln	Asp		
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Tyr	Phe	His	Pro	Phe	Cys	Phe	Ile	Gln	Asn	Tyr	Glu	Asp	Gln	Thr	Gln		
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Val	Glu	Asp	Cys	Trp	Leu	Gly	Asp	Asn	Thr	Val	Ser	Leu	Pro	Asp	Leu		
			165					170						175			
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Lys	His	Val	Gln	Lys	Asp	Phe	Trp	Pro	Gly	Tyr	Asn	Lys	Ala	Ala	Gly		
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Val	Tyr	Cys	Ile	Gly	Glu	Val	Leu	Asp	Gly	Asp	Pro	Ala	Tyr	Thr	Cys		
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Pro	Tyr	Gln	Asn	Val	Met	Asp	Gly	Val	Leu	Asn	Tyr	Pro	Ile	Tyr	Tyr		
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Pro	Leu	Leu	Asn	Ala	Phe	Lys	Ser	Thr	Ser	Gly	Ser	Met	Asp	Asp	Leu		
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Leu	Gly	Thr	Phe	Val	Glu	Asn	His	Asp	Asn	Pro	Arg	Phe	Ala	Ser	Tyr		
	290					295					300						
Thr	Asn	Asp	Ile	Ala	Leu	Ala	Lys	Asn	Val	Ala	Ala	Phe	Ile	Ile	Leu		
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Asn	Asp	Gly	Ile	Pro	Ile	Ile	Tyr	Ala	Gly	Gln	Glu	Gln	His	Tyr	Ala		
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Gly	Gly	Asn	Asp	Pro	Ala	Asn	Arg	Glu	Ala	Thr	Trp	Leu	Ser	Gly	Tyr		
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Pro	Thr	Asp	Ser	Glu	Leu	Tyr	Lys	Leu	Ile	Ala	Ser	Ala	Asn	Ala	Ile		
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	370					375					380						
Trp	Pro	Ile	Tyr	Lys	Asp	Asp	Ile	Thr	Ile	Ala	Met	Arg	Lys	Gly	Thr		
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Asp	Gly	Ser	Gln	Ile	Val	Thr	Ile	Leu	Ser	Asn	Lys	Gly	Ala	Ser	Gly		
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Asp	Ser	Tyr	Thr	Leu	Ser	Leu	Ser	Gly	Ala	Gly	Tyr	Thr	Ala	Gly	Gln		
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Gln	Leu	Thr	Glu	Val	Ile	Gly	Cys	Thr	Thr	Val	Thr	Val	Gly	Ser	Asp		

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Gly	Asn	Val	Pro	Val	Pro	Met	Ala	Gly	Gly	Leu	Pro	Arg	Val	Leu	Tyr
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His	His	Asn	Gly	Thr	Asn	Gly	Thr	Met	Met	Gln	Tyr	Phe	Glu	Trp	Tyr		
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ttg	cca	aat	gac	ggg	aat	cat	tgg	aac	agg	ttg	agg	gat	gac	gca	gct		96
Leu	Pro	Asn	Asp	Gly	Asn	His	Trp	Asn	Arg	Leu	Arg	Asp	Asp	Ala	Ala		
			20					25					30				
aac	tta	aag	agt	aaa	ggg	ata	aca	gct	gta	tgg	atc	cca	cct	gca	tgg		144
Asn	Leu	Lys	Ser	Lys	Gly	Ile	Thr	Ala	Val	Trp	Ile	Pro	Pro	Ala	Trp		
		35					40					45					
aag	ggg	act	tcc	cag	aat	gat	gta	ggt	tat	gga	gcc	tat	gat	tta	tat		192
Lys	Gly	Thr	Ser	Gln	Asn	Asp	Val	Gly	Tyr	Gly	Ala	Tyr	Asp	Leu	Tyr		
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gat	ctt	gga	gag	ttt	aac	cag	aag	ggg	acg	gtt	cgt	aca	aaa	tat	gga		240
Asp	Leu	Gly	Glu	Phe	Asn	Gln	Lys	Gly	Thr	Val	Arg	Thr	Lys	Tyr	Gly		
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aca	cgc	aac	cag	cta	cag	gct	gcg	gtg	acc	tct	tta	aaa	aat	aac	ggc		288
Thr	Arg	Asn	Gln	Leu	Gln	Ala	Ala	Val	Thr	Ser	Leu	Lys	Asn	Asn	Gly		
				85					90					95			
att	cag	gta	tat	ggt	gat	gtc	gtc	atg	aat	cat	aaa	ggt	gga	gca	gat		336
Ile	Gln	Val	Tyr	Gly	Asp	Val	Val	Met	Asn	His	Lys	Gly	Gly	Ala	Asp		
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ggt	acg	gaa	att	gta	aat	gcg	gta	gaa	gtg	aat	cgg	agc	aac	cga	aac		384
Gly	Thr	Glu	Ile	Val	Asn	Ala	Val	Glu	Val	Asn	Arg	Ser	Asn	Arg	Asn		
		115					120					125					
cag	gaa	acc	tca	gga	gag	tat	gca	ata	gaa	gcg	tgg	aca	aag	ttt	gat		432
Gln	Glu	Thr	Ser	Gly	Glu	Tyr	Ala	Ile	Glu	Ala	Trp	Thr	Lys	Phe	Asp		
	130					135					140						
ttt	cct	gga	aga	gga	aat	aac	cat	tcc	agc	ttt	aag	tgg	cgc	tgg	tat		480
Phe	Pro	Gly	Arg	Gly	Asn	Asn	His	Ser	Ser	Phe	Lys	Trp	Arg	Trp	Tyr		

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His Phe Asp Gly Thr Asp Trp Asp Gln Ser Arg Gln Leu Gln Asn Lys				
165 170 175				
ata tat aaa ttc agg gga aca ggc aag gcc tgg gac tgg gaa gtc gat	576			
Ile Tyr Lys Phe Arg Gly Thr Gly Lys Ala Trp Asp Trp Glu Val Asp				
180 185 190				
aca gag aat ggc aac tat gat tat ctt atg tat gca gac gtg gat atg	624			
Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Met				
195 200 205				
gat cac cca gaa gta ata cat gaa ctt aga aac tgg gga gtg tgg tat	672			
Asp His Pro Glu Val Ile His Glu Leu Arg Asn Trp Gly Val Trp Tyr				
210 215 220				
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Thr Asn Thr Leu Asn Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His				
225 230 235 240				
ata aaa tat agc ttt acg aga gat tgg ctt aca cat gtg cgt aac acc	768			
Ile Lys Tyr Ser Phe Thr Arg Asp Trp Leu Thr His Val Arg Asn Thr				
245 250 255				
aca ggt aaa cca atg ttt gca gtg gct gag ttt tgg aaa aat gac ctt	816			
Thr Gly Lys Pro Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu				
260 265 270				
ggt gca att gaa aac tat ttg aat aaa aca agt tgg aat cac tcg gtg	864			
Gly Ala Ile Glu Asn Tyr Leu Asn Lys Thr Ser Trp Asn His Ser Val				
275 280 285				
ttt gat gtt cct ctc cac tat aat ttg tac aat gca tct aat agc ggt	912			
Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Asn Ser Gly				
290 295 300				
ggt tat tat gat atg aga aat att tta aat ggt tct gtg gtg caa aaa	960			
Gly Tyr Tyr Asp Met Arg Asn Ile Leu Asn Gly Ser Val Val Gln Lys				
305 310 315 320				
cat cca aca cat gcc gtt act ttt gtt gat aac cat gat tct cag ccc	1008			
His Pro Thr His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro				
325 330 335				
ggg gaa gca ttg gaa tcc ttt gtt caa caa tgg ttt aaa cca ctt gca	1056			
Gly Glu Ala Leu Glu Ser Phe Val Gln Gln Trp Phe Lys Pro Leu Ala				
340 345 350				
tat gca ttg gtt ctg aca agg gaa caa ggt tat cct tcc gta ttt tat	1104			
Tyr Ala Leu Val Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr				
355 360 365				

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Gly Asp Tyr Tyr Gly Ile Pro Thr His Gly Val Pro Ala Met Lys Ser	
370 375 380	
aaa ata gac cct ctt ctg cag gca cgt caa act ttt gcc tat ggt acg	1200
Lys Ile Asp Pro Leu Leu Gln Ala Arg Gln Thr Phe Ala Tyr Gly Thr	
385 390 395 400	
cag cat gat tac ttt gat cat cat gat att atc ggt tgg aca aga gag	1248
Gln His Asp Tyr Phe Asp His His Asp Ile Ile Gly Trp Thr Arg Glu	
405 410 415	
gga aat agc tcc cat cca aat tca ggc ctt gcc acc att atg tca gat	1296
Gly Asn Ser Ser His Pro Asn Ser Gly Leu Ala Thr Ile Met Ser Asp	
420 425 430	
ggg cca ggt ggt aac aaa tgg atg tat gtg ggg aaa aat aaa gcg gga	1344
Gly Pro Gly Gly Asn Lys Trp Met Tyr Val Gly Lys Asn Lys Ala Gly	
435 440 445	
caa gtt tgg aga gat att acc gga aat agg aca ggc acc gtc aca att	1392
Gln Val Trp Arg Asp Ile Thr Gly Asn Arg Thr Gly Thr Val Thr Ile	
450 455 460	
aat gca gac gga tgg ggt aat ttc tct gtt aat gga ggg tcc gtt tcg	1440
Asn Ala Asp Gly Trp Gly Asn Phe Ser Val Asn Gly Gly Ser Val Ser	
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ggt tgg gtg aag caa taa	1458
Val Trp Val Lys Gln	
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Asn Leu Lys Ser Lys Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Trp	
35 40 45	
Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr	
50 55 60	
Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly	
65 70 75 80	
Thr Arg Asn Gln Leu Gln Ala Ala Val Thr Ser Leu Lys Asn Asn Gly	
85 90 95	
Ile Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp	
100 105 110	
Gly Thr Glu Ile Val Asn Ala Val Glu Val Asn Arg Ser Asn Arg Asn	

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Phe	Pro	Gly	Arg	Gly	Asn	Asn	His	Ser	Ser	Phe	Lys	Trp	Arg	Trp	Tyr		
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His	Phe	Asp	Gly	Thr	Asp	Trp	Asp	Gln	Ser	Arg	Gln	Leu	Gln	Asn	Lys		
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Ile	Tyr	Lys	Phe	Arg	Gly	Thr	Gly	Lys	Ala	Trp	Asp	Trp	Glu	Val	Asp		
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Thr	Glu	Asn	Gly	Asn	Tyr	Asp	Tyr	Leu	Met	Tyr	Ala	Asp	Val	Asp	Met		
		195					200					205					
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Thr	Asn	Thr	Leu	Asn	Leu	Asp	Gly	Phe	Arg	Ile	Asp	Ala	Val	Lys	His		
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Ile	Lys	Tyr	Ser	Phe	Thr	Arg	Asp	Trp	Leu	Thr	His	Val	Arg	Asn	Thr		
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		275					280					285					
Phe	Asp	Val	Pro	Leu	His	Tyr	Asn	Leu	Tyr	Asn	Ala	Ser	Asn	Ser	Gly		
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Gly	Tyr	Tyr	Asp	Met	Arg	Asn	Ile	Leu	Asn	Gly	Ser	Val	Val	Gln	Lys		
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His	Pro	Thr	His	Ala	Val	Thr	Phe	Val	Asp	Asn	His	Asp	Ser	Gln	Pro		
			325					330						335			
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			340					345					350				
Tyr	Ala	Leu	Val	Leu	Thr	Arg	Glu	Gln	Gly	Tyr	Pro	Ser	Val	Phe	Tyr		
		355					360					365					
Gly	Asp	Tyr	Tyr	Gly	Ile	Pro	Thr	His	Gly	Val	Pro	Ala	Met	Lys	Ser		
	370					375					380						
Lys	Ile	Asp	Pro	Leu	Leu	Gln	Ala	Arg	Gln	Thr	Phe	Ala	Tyr	Gly	Thr		
385					390					395					400		
Gln	His	Asp	Tyr	Phe	Asp	His	His	Asp	Ile	Ile	Gly	Trp	Thr	Arg	Glu		
			405					410						415			
Gly	Asn	Ser	Ser	His	Pro	Asn	Ser	Gly	Leu	Ala	Thr	Ile	Met	Ser	Asp		
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Gly	Pro	Gly	Gly	Asn	Lys	Trp	Met	Tyr	Val	Gly	Lys	Asn	Lys	Ala	Gly		
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Gln	Val	Trp	Arg	Asp	Ile	Thr	Gly	Asn	Arg	Thr	Gly	Thr	Val	Thr	Ile		
	450					455					460						
Asn	Ala	Asp	Gly	Trp	Gly	Asn	Phe	Ser	Val	Asn	Gly	Gly	Ser	Val	Ser		
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Val	Trp	Val	Lys	Gln													
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Ile	Gly	Ile	Thr	Ala	Val	Trp	Ile	Pro	Pro	Ala	Tyr	Lys	Gly	Leu	Ser	
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Gln	Ser	Asp	Asn	Gly	Tyr	Gly	Pro	Tyr	Asp	Leu	Tyr	Asp	Leu	Gly	Glu	
	50					55					60					
Phe	Gln	Gln	Lys	Gly	Thr	Val	Arg	Thr	Lys	Tyr	Gly	Thr	Lys	Ser	Glu	
65					70					75					80	
Leu	Gln	Asp	Ala	Ile	Gly	Ser	Leu	His	Ser	Arg	Asn	Val	Gln	Val	Tyr	
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Gly	Asp	Val	Val	Leu	Asn	His	Lys	Ala	Gly	Ala	Asp	Ala	Thr	Glu	Asp	
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Val	Thr	Ala	Val	Glu	Val	Asn	Pro	Ala	Asn	Arg	Asn	Gln	Glu	Thr	Ser	
		115					120					125				
Glu	Glu	Tyr	Gln	Ile	Lys	Ala	Trp	Thr	Asp	Phe	Arg	Phe	Pro	Gly	Arg	
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Gly	Asn	Thr	Tyr	Ser	Asp	Phe	Lys	Trp	His	Trp	Tyr	His	Phe	Asp	Gly	
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Ala	Asp	Trp	Asp	Glu	Ser	Arg	Lys	Ile	Ser	Arg	Ile	Phe	Lys	Phe	Arg	
				165					170					175		
Gly	Glu	Gly	Lys	Ala	Trp	Asp	Trp	Glu	Val	Ser	Ser	Glu	Asn	Gly	Asn	
			180					185					190			
Tyr	Asp	Tyr	Leu	Met	Tyr	Ala	Asp	Val	Asp	Tyr	Asp	His	Pro	Asp	Val	
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Val	Ala	Glu	Thr	Lys	Lys	Trp	Gly	Ile	Trp	Tyr	Ala	Asn	Glu	Leu	Ser	
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Leu	Asp	Gly	Phe	Arg	Ile	Asp	Ala	Ala	Lys	His	Ile	Lys	Phe	Ser	Phe	
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Leu	Arg	Asp	Trp	Val	Gln	Ala	Val	Arg	Gln	Ala	Thr	Gly	Lys	Glu	Met	
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Phe	Thr	Val	Ala	Glu	Tyr	Trp	Gln	Asn	Asn	Ala	Gly	Lys	Leu	Glu	Asn	
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Tyr	Leu	Asn	Lys	Thr	Ser	Phe	Asn	Gln	Ser	Val	Phe	Asp	Val	Pro	Leu	
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His	Phe	Asn	Leu	Gln	Ala	Ala	Ser	Ser	Gln	Gly	Gly	Gly	Tyr	Asp	Met	
	290					295					300					
Arg	Lys	Leu	Leu	Asn	Gly	Thr	Val	Val	Ser	Lys	His	Pro	Leu	Lys	Ser	
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Val	Thr	Phe	Val	Asp	Asn	His	Asp	Thr	Gln	Pro	Gly	Gln	Ser	Leu	Glu	
			325						330					335		
Ser	Thr	Val	Gln	Thr	Trp	Phe	Lys	Pro	Leu	Ala	Tyr	Ala	Phe	Ile	Leu	
			340					345					350			
Thr	Arg	Glu	Ser	Gly	Tyr	Pro	Gln	Val	Phe	Tyr	Gly	Asp	Met	Tyr	Gly	
		355					360					365				
Thr	Lys	Gly	Asp	Ser	Gln	Arg	Glu	Ile	Pro	Ala	Leu	Lys	His	Lys	Ile	
	370					375					380					
Glu	Pro	Ile	Leu	Lys	Ala	Arg	Lys	Gln	Tyr	Ala	Tyr	Gly	Ala	Gln	His	
385					390					395					400	
Asp	Tyr	Phe	Asp	His	His	Asp	Ile	Val	Gly	Trp	Thr	Arg	Glu	Gly	Asp	
				405					410					415		
Ser	Ser	Val	Ala	Asn	Ser	Gly	Leu	Ala	Ala	Leu	Ile	Thr	Asp	Gly	Pro	
			420					425					430			

F5

Gly	Gly	Ala	Lys	Arg	Met	Tyr	Val	Gly	Arg	Gln	Asn	Ala	Gly	Glu	Thr
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Trp	His	Asp	Ile	Thr	Gly	Asn	Arg	Ser	Glu	Pro	Val	Val	Ile	Asn	Ser
	450					455					460				
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Ile Pro Thr His Gly Val
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Ile Pro Gln Tyr Asn Ile
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